MECHANICS' MAGAZINE,

AND

REGISTER OF INVENTIONS AND IMPROVEMENTS.

VOLUME V.] FOR THE WEEK ENDING MARCH 21, 1835. [NUMBER 3.

[From the Prize Essays and Transactions of the Highland and Agricultural Society of Scotland.]

ESSAY ON RAISING AND MANAGING HEDGES.—In 1833, the Society, considering the subject of Live Fences as one of much importance, offered a premium for an approved Essay, founded on experience, on the manner of raising and managing hedges, and on the kinds of live fence suited to differences of soil, climate, and situation.

Essay: By MR. MONTGOMERY, Buchanan House, near Drymen.—Various plans are in use for raising hedges. The first is, to plant the hedge on an even surface; the second, to place it on a raised surface; the third, to form a ditch, and to plant the hedge at the surface in the side of the ditch; the fourth, to form a mound, and plant the hedge in the middle of it; the fifth, to plant a hedge on each side of the mound, thus forming a double fence; the sixth, to build a sunk wall, or to form a sloping cut, and to plant the hedge at the top of the wall or cut.

The first method, that of planting a hedge on an even surface, is represented by Fig. 1. The line being marked out, the ground should be trenched, one yard and a half wide, and eighteen inches deep; and when of bad quality, it should be improved, by adding good earth. This part of the work may be done at any time of the year. When you are going to plant your hedge, make an even downward cut with the spade the length of the line, along the middle of the trenched ground, and lay it upon one side. When this is done, drop your plants along the line, in the order in which they are to be planted, and plant them neatly to the side of the cut, placing them three or four inches apart, according to their size. When they are fixed along the line, let the mould be properly trodden to their roots; then dress the ground to the hedge. This sort of hedge requires a strong railing to be kept up, until it become effective as a fence.

The second method, although similar to the first, is yet, in my opinion, preferable, on account of the surface being raised a foot high in the middle, as shown by Fig. 2. You prepare your ground as in the first plan, but observe to throw as much mould from the sides as will raise it to the height in the middle. Then plant the hedge as above. A four feet hedge will be as good a fence on the raised surface, as one of five feet on even ground, and the expense is nearly the same.

The third plan is the usual method of making a ditch along the line, three feet inside at the surface, nine inches at the bottom, and two feet and a half deep, all the earth being thrown on the side of the ditch on which the hedge is to be planted, it being usually placed near the surface of the ground, at the edge of the ditch, as shown by Fig. 3.

The fourth plan is to form a mound two feet six inches wide at the top, five feet six inches at the bottom, and three feet high, the hedge being planted in the middle of the mound, as shown by Fig. 4.

In the fifth method there is a mound, with a hedge planted on each side, as shown by Fig. 5, the mound being three feet six inches wide at the top, six feet six inches at the bottom, and three feet high.

The sixth plan, Fig. 6, is to have a sunk wall, two feet nine inches in height, two feet wide at the bottom, and ten inches at the top. The wall should be perpendicular in front, having the slope all at the back, from the bottom to the top; the back should be well packed or built, filled with good earth, and the hedge planted close to the top of the wall. This, in my opinion, is the most efficient fence, and in the end the cheapest. The hedge should not be allowed to grow higher than two feet and a half. When stones are not easily got, you have only to use turf a foot or nine inches high, if the ground is good, and this turf you can get from the surface you move in making the sloping cut. Where the ground is good, raise the wall or building with turf nine inches above the original surface; when poor, raise it a foot, and fill it well up at the back with the best of the earth for the hedge, which is to be planted a foot back from the front. The cut requires to be only two feet deep if the ground is good, and one foot nine inches deep when it is poor.

The next thing to be considered is the expense of executing the work in the different ways. According to the first two plans, where the ground can be worked with the spade, the expense is nearly equal, as the additional work in raising the surface in the second plan is balanced by the expense of staking being less than in the first, a stab or stake four feet long on the raised

Fig. 1.

Fig. 2.

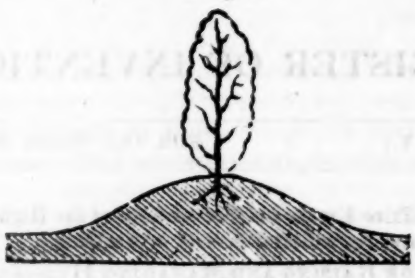


Fig. 3.

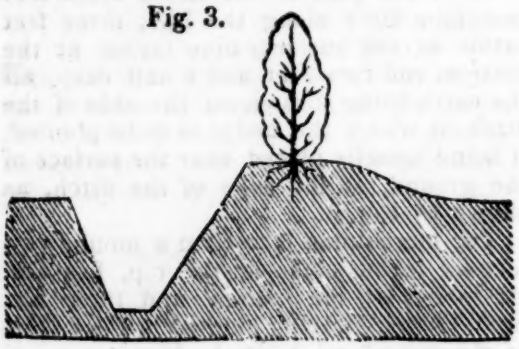


Fig. 4.

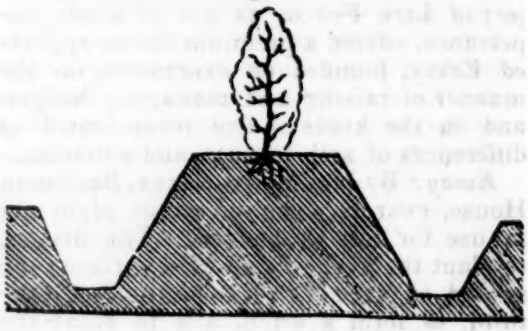


Fig. 5.

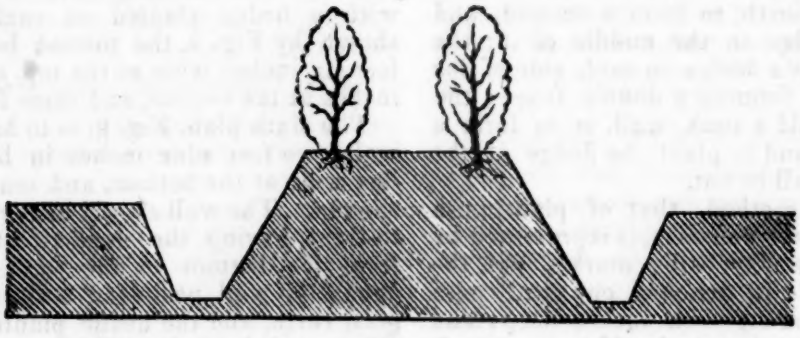
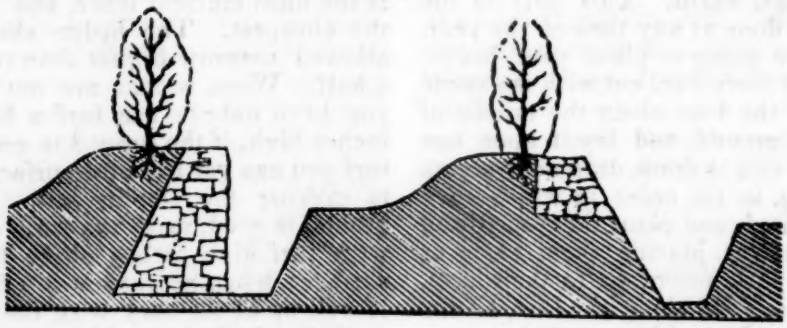


Fig. 6.



surface being equal to one of five feet on the even surface.

Trenching the ground a yard and a half wide, one foot six inches deep, can be done per lineal yard at	£0 0 1½
Taking out the spading along the middle, and planting the hedge	0 0 1
Expense of plants, nine or ten to the yard	0 0 2½
Expense of railing, five-feet stakes, two to the yard, rafter and nails	0 0 2½
Amount per lineal yard	£0 0 7½

In the second plan, the railing requires a stake of only four feet, and, in my opinion, a hedge on the raised surface will become a fence two years sooner than one on the even surface. There is also one-fourth less expense in the annual dressings. The cause of this is obvious, as a hedge on the raised surface is as good a fence three feet high, as a hedge of four feet on the even surface.

Expense of trenching and raising the ground per lineal yard	£0 0 2
For plants and planting the hedge	0 0 3½
For four-feet stakes, two to the yard, rafter, nails and putting up	0 0 2½
Amount per lineal yard	£0 0 7½

In the third plan, or the common way of a ditch and a hedge on the side, the usual way is, when the ditch is cut on each side, to take a good turf, and lay it with its grass side downwards, on the side of the ditch where the hedge is to be planted. Lay the turf to fit the slope of the ditch, the slope to be six inches in the foot. Then plant your hedge, nine or ten plants to the yard, with the tops of the plants even with the slope of the ditch, on the top of the turf, putting the good surface-mould to the roots of the plants, and throwing the rest of the earth that is taken out in forming the ditch to the back of the hedge. This method of planting the hedge I do not approve, for the following reasons. The first year the hedge looks likely to succeed, but the second year the frost during the winter loosens the earth about the roots, when much of it falls down into the ditch, and the roots of the hedge become exposed, and are injured by the dry weather in summer, so that the hedge makes little progress, and becomes stunted in its growth.

Expense of forming the ditch, as shown by fig. 3, per lineal yard	£0 0 2
Expense of plants, and planting the hedge, 9 or 10 to the yard	0 0 3½
Three-feet stakes, rafter, nails and putting up,	0 0 2
Amount per lineal yard	£0 0 7½

According to the fourth plan, you begin with a surface three feet and a half wide, building up the sides with turf a foot high on each side, and sloping six inches in the foot, which will make the top of the mound two feet six inches wide; and on each side make the sloping cut two feet high, which makes the mound five feet six inches wide at bottom. The good earth moved in making the sloping cut is to be thrown into the mound, in sufficient quantity to allow for subsiding.

Expense of forming the mound per lineal yd.	£0 0 2½
Do. of plants and planting along the middle of the mound	0 0 3½
Do. of stakes of two feet six inches, rafters, nails, and putting up	0 0 1½
Amount per lineal yard	£0 0 7½

The fifth plan being somewhat similar to the fourth, only having a double hedge, will require three feet six inches of width at the top, four feet six inches at the surface, and six inches at the bottom. The sloping cut on each side is shown by fig. 5.

Adding 2½d. per lineal yard to the expense by the fourth plan, that of the present will amount, per lineal yard, to	£0 0 9½

I would here observe, that the single hedge planted in the middle is the most advisable, and in my opinion the best fence. I would by no means recommend the mound-fence in dry ground, as in that case the mound will get into a state of aridity, and the plants will not grow. Furze may answer in such a case, but nothing else. I certainly give the preference to the mound with the hedge in the middle, it being the least expensive, the least troublesome in its management, and the more certain of the two to become a good fence.

The plan shown by fig. 6 is the sort of fence which I would particularly recommend as the most substantial and efficient for inclosing ground for planting, and in every respect the most effectual in the shortest time, and attended with the least expense in the management after being planted.

The expense of the first method shown by fig. 6, or when built with stone in front, is as follows:

For building and sloping the ground, per lineal yard	£0 0 6½
Expense of plants and planting the hedge	0 0 3
Railing stakes two feet, rafters, nails, and putting up	0 0 1½
Amount with stone facing, by the sixth plan,	£0 0 11

When the side is built of turf, the expense is as follows:

For building the side, and sloping the ground, per lineal yard	£0 0 2
Expense of plants and planting	0 0 3
Railing 2-feet stakes, rafters, and putting up,	0 0 1½
	£0 0 6½

The last plan with turf, as shown by fig. 6, is the cheapest in putting up, but that with the wall in front is the best. The great advantage is the planting of the hedge a foot back from the front, at the top of the building with stone or with turf. This allows the hedge to have a plentiful supply of moisture at the root, without being injured by the changes of the season. The railing is less expensive, as the hedge will become a fence in half the time required for the first and second methods, and the hedge in either of the last two plans being a good fence when two feet high, whereas, by the first two plans, it will require to be four feet high.

The mound-fence, with the hedge in the middle, would, in favorable situations, be a good fence in the same period as by the last methods; but there are few situations that suit this mode of fencing, for the reasons already stated.

I have now to speak of the different sorts of plants used in making fences. The following are the kinds respecting which the society demands information, with their prices per thousand.

Hawthorn, *Cratægus oxyacantha*, 20 to 24 inches high	8s. to 10s.
Beech, *Fagus sylvatica*,	15s. to 20s.
Hornbeam, *Ostrya vulgaris*,	15s. to 20s.

Birch, *Betula alba*,..... 15s. to 20s.
Holly, *Ilex aquifolium*,..... 50s.
Furze, *Ulex europæus*,..... 15s. to 20s.

To these may be added,

Yew, *Taxus baccata*,..... 100s.
Evergreen Privet, *Ligustrum vulgare*,..... 15s.
Elder, *Sambucus nigra*,..... 30s.

The thorn, hornbeam, holly, and yew, are raised from seed, generally sown in autumn; the beech and whin are sown in spring; the evergreen privet and elder are raised by cuttings four or five inches long, planting them in the ground early in March, in rows of a foot between, and three inches in the row. More sorts might be added, but the above are those most approved of for live fences.

The hazel, birch, and whin, I do not hold in much estimation, whether used singly, or mixed with others. The two first do not repel cattle, and sheep destroy the whin in winter, nor would it mix with other plants to advantage. The birch is too pliant when young, the hazel grows too open and large in the leaf to mix, and in my opinion none of these should be used in live fences.

The thorn, the holly, and the yew, are well known, and require nothing to be said in their recommendation. The beech, hornbeam, elder, and evergreen privet, are particularly suitable for mixing in live fences, and are also long-lived plants.

Those which I would most recommend for being generally useful as fences, are the thorn and evergreen privet, the elder and evergreen privet. When the hedge is of the first two, let the proportion be two plants of thorn to one of privet; when of elder and evergreen privet, let the number be equal; when of thorn and beech, let there be two of the thorn to one of the beech; and when of thorn and hornbeam, let them be alternately planted.

The thorn and hornbeam, the thorn and beech, the elder and hornbeam, and the elder and beech, make good hedges, and have a reddish appearance during winter. The evergreen privet, mixed with thorn or elder, makes a very good hedge, and has a beautiful olive green appearance during the winter, when dressed in proper time in summer. Therefore I consider it the best plant to mix with the thorn, or with the elder, as the cattle do not eat it so readily, nor have I seen it infested with any sort of insect. The leaves being small, are not injurious to the hedge; the roots are also very numerous, and soon fix the mould at the surface, so as to prevent it from falling away from the hedge, or tumbling down into the ditch.

Hedges should be cut or dressed in the middle of summer, and the usual way of dressing them only in winter is very objectionable, the growth of the hedge being, as it were, lost; from being allowed to grow at the top all the season, it becomes there luxuriant, while at the bottom very little progress is made, and in a few years it becomes quite naked below. By cutting the hedge in summer, an equal growth is produced all over, from the bottom to the top; and by the second growth its closeness is increased, and the hedge greatly improved. The dressing should take place from the 20th of June to the middle of July, according to the advanced growth of the hedge. By attending to this plan of dressing your hedges twice in the year, you would do them in much less time than would be the case were you to allow them to grow on all the season without cutting.

The season for planting hedges is often too little attended to, such work being left until spring; but the proper time is when the leaf begins to drop from the young thorns. I recommend planting hedges in November and December, and not later than February; for then the juices begin to circulate, and cutting the roots after that period allows the sap to escape, and thus retards the growth of the plant the first season. The hedge ought to be planted, as recommended, with well selected plants, from twenty to twenty-four inches high, and two years transplanted. They are to be cut down to twelve inches, and if properly planted will make fine strong shoots the first year, which should not be cut until winter, when the hedge is to be dressed in the wedge form to 18 inches high. After the first year dress your hedges in summer, and in the end of the season, increasing them gradually to the height required.

When the hedges are well managed, those at the top of the sunk wall, or building of turf, as shown by fig. 6, will be a good fence the third year; on the raised surface in four years; and on the even surface in six.

On the subject of weeding the hedges and cleaning the ditches, a great deal might be said, were I to follow the ordinary practice; but the method which I recommend is simple, and requires few words. When your hedge is planted, sow on each side of it white clover seed, to the breadth of from two to three feet, as early as you can in spring; and once or twice during summer cut the grass with a short scythe, or a grass hedge-hook. If thistles, docks, or other strong weeds, rise, remove them; but never dig about your hedges, unless you are going to add plants. Let the grass be kept down two or three feet out from the hedges, and dress them as directed.

Specification of the Patent granted to JOHN BAPTISTE CONSTANTINE TORASSA, *and others, for certain Improvements in Making or Producing the Pigment commonly known by the name of White Lead or Carbonate of Lead.* Sealed December 11, 1833.*

To all to whom these presents shall come, &c. &c. Now know ye, that in compliance with the said proviso, we, the said John Baptiste Constantine Torassa, Paul Isaac Muston, and Henry Walker Wood, do hereby declare the nature of the said invention to consist in making or producing the pigment commonly known by the name of white lead without the use or employment of vinegar, or acetic, or acetous acid, in any other form or under any other name, and without the aid of artificial heat, except for the purpose of drying the white lead, as hereinafter mentioned, by reducing the ordinary lead of commerce, by friction in water, to a very fine powder, and then exposing the said powder to atmospheric air, so that it may acquire both oxygen and carbonic acid, and thus be converted into the pigment aforesaid.

We cut common sheet lead into very small pieces or grains, or, what is preferable, we form lead into what may be termed shot, in the same manner as patent shot is made, except that no other ingredient is used to cause the lead to cool in a perfect round form. The exact shape of the pieces of lead is immaterial, but the shape of shot is the most convenient. These shots or pieces of lead should be about the size of *duck shot*, and having procured any given quantity, we place them in an open shallow wooden vessel lined with sheet lead, which we call a friction vessel, covering the bottom of the vessel with the shot or pieces of lead to the depth of about one inch, and then add water sufficient to cover them, but not more. We then tip the vessel containing the shot or pieces of lead, from side to side, in such manner as to cause the shots or pieces of lead to roll backwards and forwards on the bottom of the vessel, and thus produce great friction of the pieces of lead, one against the other, and this friction will produce an extremely fine powder of lead mixed with the water, from which it will separate easily, if left to subside. We then remove the moist powder, which is at an early period of the process of a dark color, pass it through a fine sieve, and expose it for about eight or ten days to atmospheric air, whilst the power is still in a moist state, and about the consistence of thick cream, in another shallow open vessel, which we call the carbonating vessel, where we agitate or stir it constantly, in order to expose it as much as possible to the action of the atmospheric air, until it assumes a beautiful white color, and is thus converted into the pigment commonly known by the name of white lead or carbonate of lead. The carbonating vessel may be made of any convenient material, but we prefer wood as nearly colorless as possible. When the white lead is thus produced, if it should still contain any moisture, it should be well dried before it is put into casks for sale.

Now, whereas we do not claim as the said invention the form of the friction or carbonating vessels here given, or the particular manner hereinbefore described of agitating the lead, though the foregoing is the process we usually employ as being the best adapted of any we now know of for the purpose, when engine-power is not used; but we claim as the said invention the following improvements, (that is to say,) making white lead without the use of vinegar or acetous acid, in any other form or under any other name, and without the aid of artificial heat, except for the purposes of drying the white lead, as hereinbefore mentioned, and converting the ordinary lead of commerce into the pigment commonly known by the name of white lead or carbonate of lead, by reducing it to a fine powder by friction, as aforesaid, and then converting that powder into the said pigment by exposing it to the action of the atmosphere, as hereinbefore described. And such invention being, to the best of our knowledge and belief, entirely new and never before used, we do hereby declare this to be our specification of the same, and that we do verily believe this our said specification doth comply in all respects fully and without reserve or disguise with the proviso in the said

* The engraving and description of it are omitted. We give merely the process of manufacture.—[Ed. M. M.]

hereinbefore in part recited letters patent contained; wherefore we do hereby claim to maintain exclusive right and privilege to the said invention. In witness whereof, &c.

Enrolled June 10, 1834.

[From the Scientific Tracts and Family Lyceum.]

Notes on the Study of Natural History.

BY BENJ. F. NUTTING.

Having taken a view of the principal features of the earth's surface, we shall next devote a few thoughts to the animated beings with which it is peopled. The first of these is man—man formed in the image of the Creator—the greatest wonder of the whole. Though fallen from his first estate, he retains, like mutilated sculpture, some markings which indicate his high and lofty origin. How admirable is his physical structure! Of the efforts of his mind how admirable and how wonderful have been the results! Still no created objects can satisfy the capacious grasp of his soul. Onward, onward—more of knowledge, more of gain, more of *something*, is still his desire; and how much soever he attains to, yet his soul is not satisfied, and until he applies to the same power whence he issued, he must remain restless and unsatisfied.

Next to man are the quadrupeds, of various forms, habits, and color—inhabiting various climes, and subsisting in various ways. Some—and perhaps all, if we viewed them aright—remarkable for symmetry of form, some for the beauty of the dyes with which their fur is ornamented, others endued with a wonderful strength, or with an agility and a fleetness that man has never attained to; some gathering their sustenance from the herbage, and others preying upon animals which are feebler, less subtle, or provided with less destructive weapons. They vary also in size, from the ponderous elephant to the diminutive field mouse.

The class of animals next in interest is that of birds. They differ greatly from quadrupeds in their form and in their covering, but more especially in their means of locomotion. While the latter are confined to the ground, and must overcome or wind about the obstructions that lie in their passage from one place to another, birds raise themselves above all these, and move freely and swiftly wherever the calls of nature direct them. There is in birds the same variety of form and color that we find in quadrupeds. Their range in size, however, is not so great. The largest bird does not exceed in size quadrupeds of no more than medium bulk; and the smallest is scarcely less than the smallest quadruped.

The sea has also its inhabitants. We read that at the creation, 'the waters brought forth abundantly'—but *how* abundantly, perhaps, few are aware. When we again reflect upon the immensity of the sea, we must perceive that if its waters are but moderately supplied with inhabitants, their number must be almost beyond calculation. But the truth is, they are 'abundantly' supplied. What a mass of life then must they contain! As the element in which fishes live differs greatly from that of quadrupeds and birds, their construction and mode of life are consequently very different. In size, no quadruped will bear any comparison with the whale; and neither, on the other hand, can a quadruped or bird be found so diminutive as the smallest fish.

Insects form another and a very interesting department of animated nature. Their number is immense. Their structure differs materially from all the classes we have been considering, and nowhere are the wisdom and goodness of God more manifest than in this minute part of his creation. The science that treats of insects, is, to those who pursue it, one of the most engaging departments of Natural History.

The very name of reptiles, the next class of animals to be noticed, produces a shudder or a feeling of disgust in many, but it cannot be doubted that they are an important part of creation; and an inquiry into their nature and habits can be made a pursuit of great interest and instruction. They comprise the various tribes of serpents, the alligator and crocodile, the toad, the lizard, &c.

The remaining division of animals is that of animalculæ. The thousands of these minute particles of life which a drop of water can contain, is a fact so often noticed and wondered at, that it is hardly necessary that it should be mentioned.

We have thus taken a slight survey of

the animals constituting the world of life. Various in their formation, and in the requisitions for their support, but all provided for with a wisdom and a regard for their necessities, which we hope to give some illustration of hereafter.

In order to complete this view of nature, there are other things at which we should glance. One of them is the element by which we are surrounded. The air is necessary to the support of both vegetable and animal life, and also to the preservation of fire, another element of the highest importance, if not indispensable to man. It is the air which raises from the sea the purified particles which are united and sent down to us again in fertilizing rains. It is this which supports the birds in their flight, and wafts the produce of one clime to another.

Besides the difference in temperature occasioned by a more or less vertical exposure to the rays of the sun, there are local causes of variation in climate. Parts of Europe are much milder, and subject to less severe transitions in this respect, than the same latitudes in this country. In Asia, as the high table land is approached, a great change of climate is very suddenly experienced. The variation of climate leads us to consider those periodical changes of temperature and aspect, occasioned by the inclination of the axis of the earth, during the progress of our planet round the sun.

The divisions of the year into spring, summer, autumn, and winter, are not exactly, though nearly, according to nature. The astronomical division is made by the vernal and autumnal equinoxes, and the summer and winter solstices; that is, from the 21st of March, when the sun crosses the equator, to the 21st of June, when it reaches its highest northern declination, is the astronomical spring in the northern hemisphere; from the 21st of June to the 23d of September, when the sun again crosses the equator in his journey south, is the summer; from that time to the 22d of December, when the sun attains his greatest southern declination, is the autumn; and from that time to the 21st of March, is the winter. When we have spring, the inhabitants of the southern hemisphere have their autumn, and so of the other two seasons. The southern winter is about a week longer than ours, as may be seen by making the calculations.

The parts of the earth near the equator have no winter, nor any other division of seasons, than that of wet and dry. The winter of the northern polar regions is long and severe; but in neither of these respects is it equal to those of the south. This may be occasioned by the earth's being at the point of its nearest approach to the sun during the northern winter, and at that of its greatest distance during the winter of the south.

The diversities in the aspect of the earth wrought by this change of seasons—the joyful resuscitation of nature in the spring, the glowing beauties of summer, the present season of poetical and moral reflections, the drear and yet social winter, have been too often dwelt upon, to be suggested to your remembrance at the present time.

We have thus taken a very slight view of that part of the dominions of the King of kings, which he has allotted to us as an abode. We shall close these observations for the present by suggesting a few motives for pursuing the study of this science.

1. It does not require intense application, or many books. After some elementary direction books, we are prepared to observe for ourselves, and to draw instruction from objects which are continually around us.

2. It is a subject of interest at the present time; and if we endeavor to obtain such a knowledge of nature as our opportunities allow, we must necessarily become wiser and better.

3. Natural History is, as we have seen, a description of every thing, and as it consequently includes all kinds of knowledge, it must aid in every scientific pursuit. A knowledge of nature is also important to the poet and those engaged in other departments of literature. This is the source from which all the imagery of the former, and all the illustrations of the latter, must be drawn.

4. But more than all this, it leads to a knowledge of God, whose attributes are revealed in his word, and clearly seen in his works. Wisdom and goodness are manifest in them all, and the pious man, who is conversant with them, discovers wisdom and goodness displayed in every

object about him. David's frequent reference to them shows that the contemplation of nature frequently occupied his thoughts.

5. We have reason to believe that the happiness of heaven, in part, will consist in a more extended and minute knowledge of the works of God. No part of creation is unworthy of its Divine Author, and a contemplation of this broad field cannot be an employment unsuited, according to the philosophy of the learned Dr. Dick, to the holy inhabitants of the New Jerusalem.

Man is the minister and interpreter of nature, said a great philosopher; and he ought unquestionably to commence the study of the important science of nature by becoming acquainted with his own species in every form of existence, and in every stage of society, from the erratic savage of the forest to the polished inhabitant of the city. In this country we behold man in every shape and modification of insulated and social being. When we peruse Herodotus' description of the Scythians, Thucydides' of the ancient Grecians, Cæsar's of the Gauls and Britons, and Tacitus' of the Germans, we perceive the prototypes of our Indians; but we have it in our power to view man in a savage state with our own eyes, without relying on the reports of others; and it is to be regretted that so much time has transpired, without more attention being bestowed on this interesting subject. Dr. Robertson says, 'almost two centuries elapsed after the discovery of America, before the manners of its inhabitants attracted, in any considerable degree, the attention of philosophers.' This neglect can, perhaps, never be fully retrieved. An intercourse with civilized man has changed our Indians in almost every respect; but there is still a sufficient remnant of their manners, languages, and traditions, left to interest inquiry, and invite investigation. In some very remote quarters, they may still be found in the unsophisticated forms of original barbarism, unaltered by extrinsic intercourse. Many of their languages may still be redeemed from oblivion, their persons may be delineated, and their manners and traditions may be described; and the knowledge which may be obtained, added to what has already been collected, may furnish invaluable illustrations of the human species. The number of languages in Mexico is thirty-five, of which fourteen have grammars and dictionaries. The Bible has been translated by Eliot, the Indian apostle, into the Algonquin language; and two thousand copies of the Mohawk version of St. John's Gospel have been printed by the British and Foreign Bible Society; and we have many collections of words in different Indian languages. Our antiquities are of two kinds, such as relate to the aboriginal and colonial states. We have no Indian monuments or curiosities that can be compared with the forts on the Ohio, or with the temples of the Aztecs. There are some remains of Indian pottery, of weapons, and of rude paintings. Mounds of earth, like the tumuli in Scandinavia, Russia and Tartary, the barrows in England, and the cairns in Scotland and Ireland, may still be seen, and also the outlines of extensive fortifications. But the variegated condition of the white man here exhibits human nature in all its shapes. We behold him in every stage of society, from the semi-savage hunter to the polished citizen; and we perceive every stage of cultivation, from the first tree that was cut to the elegant habitation. 'In North America,' says a distinguished writer, 'a traveller who sets out from a great town, where the social state has attained to perfection, traverses successively all degrees of civilization and industry, which keep diminishing, till he arrives, in a few days, at the rude and unseemly hut formed of the trunks of trees newly cut down. Such a journey is a sort of practical analysis of the origin of nations and states. We set out from the most complicated union, to arrive at the most simple elements. We travel in retrogression the history of the progress of the human mind, and we find in space what is due only to the succession of time.'—[Scientific Tracts.]

Musci, or Mosses.—There are about 40 genera, and 330 species of this class. They are called winter plants, and are found to cover mountains as high as perpetual snow. Growing in patches, they cover the most barren spots, and thus prepare the earth for other vegetation. When growing on trees, they protect them from the winter's severity.

[From the Journal of the Franklin Institute.]

Report to the Board of Directors of the London and Birmingham Railway, on the Formation of a Railway by Undulatory Planes. By Robert Stephenson, Esq., Engineer. Dated 5th May, 1834.*

Since the receipt of the memorial to the directors, respecting the formation of railways by undulatory planes, I need scarcely say that I have been so closely occupied, that I found it impossible to reconsider, carefully, the opinions I had formed on the subject several months ago, founded upon some experiments in "The Gallery of Practical Science," with a model prepared by Mr. Badnall. These experiments were considered by several persons conclusive in favor of an undulatory surface for a line of railway.

I drew a different conclusion from them, and made some remarks and calculations at the time, which I considered fully confirmed it. Since that time, I have read the greater part of the controversy, which has been carried on in the "Mechanics' Magazine," and paid especial attention to the experiments made upon the Rainhill plane, with several of the locomotive engines belonging to the Liverpool and Manchester Railway Company, without perceiving any reasons for changing the view I originally took.

The following observations are extracted from those above alluded to, as far as appears necessary for explaining the outline of the arguments upon which I had based my views:

A C, a horizontal plane.

A B, and B C, two inclined planes completing one undulation.

A carriage, in moving over the inclined plane, may be conceived to be acted upon by three forces, viz.

First.—Gravity, varying directly as the *sine* of the angle of inclination.

Secondly.—Mechanical force, such as a steam-engine, or a spring.

Thirdly.—The uniform retarding force, arising from the friction of the moving parts.

Let n = sine of angle of inclination.
g = force of gravity.
m = mechanical force applied.
f = retarding force arising from friction.

Then the force resulting from the combined action of these three, will be represented by $n\,g + m - f - (m - f;)$ it is evident that the motion of the body is influenced solely by the remaining force $n\,g$, and is precisely in the same condition as if friction were annihilated.

In this case, it is obvious that the body descending the plane A B, would acquire sufficient momentum to carry it up to the similar plane B C; and were there a series of similar undulations, the body would move forward without interruption, and the velocities in each succeeding undulation would be the same, and the expenditure of mechanical power would be the space passed over, multiplied into the retarding force $= s\,m$, or $s\,f$, s being the space passed over.

Instead of moving on an undulating surface, let the body be now placed on the horizontal plane A C; its motion in this condition can be influenced by two forces only, viz. the mechanical force m, and the retarding force f. If we suppose, therefore, $m = f$, it is obvious that no motion whatever can take place.

At this point of the comparison, a striking difference, and apparently not an unimportant one, exists between the undulatory and horizontal surfaces. In the former, gravity communicates a certain velocity, which is maintained throughout each succeeding undulation; whereas, in the latter, the forces m and f merely destroy each other; consequently the body remains stationary.

This explains the experiment which was frequently repeated, and in many cases went far to convince several persons of the advantage of having an undulatory surface. Very little reflection, however, is requisite to perceive that this advantage is merely apparent, and not real: for let us suppose that the body at A, on the horizontal plane, has the mean velocity given to it, which gravity imparts to the body moving down the first inclined plane of the undulatory surface; it will then move uniformly with this velocity from A to C, and arrive at the latter point at the same time that it would have done on the undulatory line; and however the length may be increased, the body will

* We have received from Mr. Stephenson, in addition to the manuscript now printed, one containing remarks and calculations on the best form for railway bars, &c., the publication of which we propose to commence in the next number.

pass over the distances corresponding to each undulation in the same space of time, whether the surface be undulatory or horizontal.

Let p = power expended in communicating any given velocity to the body on the horizontal surface at A; then the whole power expended in moving the body from A to C, will be $p+s\,m$, or $p+s\,f$.

But when the body arrives at C, it retains its original velocity, and is capable of employing its power, or of moving itself beyond C; whereas, on the undulating surface, the body becomes quite stationary at C. In short, it is a well known law in mechanics, that the velocity which the body possesses, is exactly equal to the power expended in communicating it; we therefore have the absolute expenditure of power in moving the body from A to C = $s\,m$ or $s\,f$, which is precisely the same result as on the undulating surface.

Hitherto we have the forces m and f equal, by which the friction, or retarding force, was merely neutralized; but in practice, m must exceed f, otherwise no motion could ensue on the level plane. When, therefore, m is greater than f, the body will be accelerated by the differences of those forces, viz. $m-f=d$; in this case the motion of the body on the undulatory surface is influenced by a force represented by $n\,g+d$.

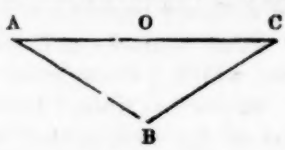
If v and v'' represent the velocities generated by the forces $n\,g$ and d, in the same time, then $v+v''$ will represent the velocity which the joint forces will generate in an equal space of time. But the velocity given by the force $n\,g$, in descending, is lost in ascending; hence, the body will arrive at the summit of each undulation, with the velocity due to the action of the force d, which is $\sqrt{2\,d\,s}$.

Now, the velocity acquired by the action of the force d on the level plane, the body having moved over an equal space, is also $\sqrt{2\,d\,s}$; and this equality in velocity must hold, whatever be the nature of the surface over which the bodies move, undulatory or level.

If the body were actually propelled by the force d, more efficiently on the one surface than on the other, it must arrive at the point C, with different velocities. The readiest mode of showing that this is not the case, is to allow it to expend the momentum by moving along a horizontal plane, or one of a given inclination; in both cases, the momentum is precisely equal. This experiment I repeated several times, and felt perfectly convinced that the results were exactly determined.

It has been urged by some that the undulatory surface has an advantage from the friction being reduced, in consequence of the body being on an inclined surface. A moment's consideration will show that this never can apply in practice, from the smallness of the inclination which is admissible; the reduction in the friction from this cause would be inappreciable.

But even allowing it to operate, the undulating surface is increased in length by a quantity that exactly compensates for the reduction in the friction of the carriage.



Because the diminution of friction is proportioned to the diminution of weight, which is as A B, A O, but the spaces passed over are as A C: A B+B C, or as A O: A B, exactly the reverse of the former proportion; showing, that though the friction may be reduced on the inclined plane, the distance is increased precisely in a ratio to compensate it.

The above considerations lead me to conclude that, theoretically, there is neither advantage nor disadvantage in the use of an undulating surface for a line of railway; the question, therefore, resolves itself into one of practical application. This I have frequently and carefully considered, and, generally, with a strong bias in favor of Mr. Badnall's view, because I saw clearly that its introduction would at least reduce the expense of constructing public lines of railway; but I have invariably been compelled to conclude that its adoption would be attended with greater expense in the carriage, greater uncertainty in the operation, in many cases greater inconvenience, and in all greater risks of accidents, than in a horizontal line of railway, or on one approaching to it as nearly as circumstances would permit.

Greater ultimate expense, I conceive, would arise in part from the additional wear and tear, both upon carriages and engines, from the varying velocities which must be

continually taking place throughout the whole length of the line of road.

This objection is considered by many of no weight; I need only refer, however, to practical men, who have been in the habit of observing the destruction of machinery where varying velocities are admitted; indeed. I cannot refer to a better instance than Rainhill and Sutton inclined planes, where the objectional nature of inclined planes is evident to all conversant with machinery, and from whence (it is probably not too much to say) a very large portion of the wear and tear of the locomotive engines on the Liverpool and Manchester Railway has sprung.

The engines on an undulating line must obviously, at the bottom of each undulation, attain a velocity considerably greater than what is required upon a horizontal line, where it may be nearly uniform.

Now, in locomotive engines, this single circumstance gives rise to three separate objections, neither of which is undeserving of attention, and which are distinct from that of wear and tear arising simply out of velocity.

First.—In the construction of these machines, it is a consideration of the very first importance, to proportion and adapt the relative speeds of the different parts to the velocity at which the engines are intended to travel; and though I am perfectly aware that these engines are worked at different rates of speed, I have seen sufficient to convince me that uniformity in the velocities is extremely desirable, and that they never perform so economically as when the intended velocity is adhered to within very narrow limits, which is quite impracticable on an undulating road.

Secondly.—When the velocity of these engines exceeds that for which they are calculated, the steam acts less forcibly on the pistons, and thus produces an absolute loss of power, or, in other words, an increased consumption of fuel.

Thirdly.—From the present construction of locomotive engines, every different speed of travelling is accompanied with a corresponding increase or diminution of the temperature of the fire, which occasions a continual working amongst the different parts of the boiler, from unequal expansion and contraction, which never fails in a short time to render the boiler more or less leaky.

Every experienced steam-engine builder has had instances brought under his observation, of the destruction of boilers by being exposed to great variations of temperature. In all railways, except such as are perfectly horizontal, this objection applies with more or less force. I therefore only mention it in this place, to show the tendency of the undulating railway would be to aggravate the evil arising from great inequalities in the temperature.

These are my principal reasons for concluding that the expense of carriage would be greater on an undulated line, and the same remarks appear to me to lead to the conclusion, that there would be greater uncertainty in the operation.

Inconvenience would, in my opinion, result from not having the power to halt at any given point on the line of railway. This may be done without inconvenience, on a line of road not possessing inclinations beyond the power of the engines; but where the inclinations of the planes exceed that power, it is clear that some expedient must be contrived to overcome the delay that must ensue. I have only heard of one, which I cannot suppose to have been advanced seriously. I allude to the proposal that an engine, when stopped by any chance on an inclination beyond its power, should be worked backwards and forwards until sufficient momentum be acquired for surmounting the next summit.

This is an operation not only of time, but in many cases would be imminently dangerous, and could not fail to be a continual source of annoyance.

When it is stated that the risk of accident would be increased, it must not be inferred that increase of speed is attended with greater frequency of accident, but rather that such mishaps are likely to be more extensive and serious when they do occur.

I now come to consider more immediately the chief object of the memorial which has been laid before the directors, viz. The expediency of making an experiment on the London and Birmingham Railway, extending over a distance of eight or ten miles, as suggested by Dr. Lardner and Dr. Dalton.

In recommending the directors to make such an experiment, those gentlemen have evidently been influenced by the statement in the memorial, that it would not cost over £500, and that the experiment, should it fail, would be productive of no detriment to the Railway Company.

I have thoroughly considered the expense

of such an experiment, and also the probable inconvenience that would arise out of its failure, and supposing the latter result, I am satisfied it could not cost the Railway Company less than £8,000 or £10,000; and this sum may be made to appear without taking into the account many contingencies that would necessarily attend such a circumstance.

The ballasting and laying the rails alone costs from £800 to £1,000 per mile, and this charge must unquestionably be incurred in merely transforming the undulated surface to an uniform one. The embankments would require to be brought to a higher, and excavations to a lower, level; thus interfering with the whole of the bridges, over and under the railway.

In short, you could only prepare for the contingency of a failure, by erecting temporary bridges over the railway, throughout the ten miles, until the utility of the scheme had been determined.

These, and other considerations, connected with the detail of executing the railway, which it would be superfluous to enter into here, and which it would be impossible to render intelligible in a report like the present, fully convince me that it would be at least rash to advise an expensive experiment on the London and Birmingham Railway, which, in any event, could only save a very small sum in the original expenditure, with the possibility of your not succeeding to your expectations; thus producing a result fraught with mischief to the undertaking generally.

I feel it, however, due to Mr. Badnall, to state that I consider a trial upon some branch road might be made with advantage, as the adoption of his ideas would certainly be productive, in many cases, of considerable saving in the first cost, which, in some branch roads, is of paramount importance.

I must, however, again repeat, that no saving of power could be by any possibility effected. ROBERT STEPHENSON.

[From the Repertory of Patent Inventions.]

Specification of the Patent granted to CHAS. ATTWOOD, *of Wickham, near Gateshead, in the County of Durham, Glass Manufacturer, for a certain Improvement or Improvements in Manufacturing or Purifying Soda.*—Sealed October 19, 1834.

To all to whom these presents shall come, &c. &c.—*Now know ye*, that in compliance with the said proviso, I the said Charles Attwood, do hereby declare that the nature of my said invention, and the manner in which the same is to be performed, are particularly described and ascertained as follows, (that is to say:)

I do declare the said invention to consist in the purification of such soda as is contained in the substances usually known or met with in commerce, under the name or names of soda, barilla, natron, mineral alkali, or kelp, or English or artificial soda or barilla, or soda-balls or lumps, whether such soda may exist in such substances in a state of combination with earthy or other more or less insoluble substances, or whether separate from such earthy or insoluble substances, and whether in solution or otherwise, or under whatsoever name or names the various articles of which soda, in either a caustic state or state of combination with carbonic acid, may be manufactured or produced, or be found in trade or commerce, in so far as the same may require or beneficially admit of such purification as aforesaid. And I do further declare, that the impurity from which I do profess to purify such soda, by my said invention, is such sulphur as may exist in a state of chemical combination, with a part thereof in such substances so manufactured or produced, or so met with in trade or commerce, as aforesaid, or such sulphur as through or by means of any subsequent lixiviation of, or other operation on such substances, may enter into chemical combination with a part of such soda, such combinations of sulphur with soda forming the compounds which are included, in common language, under the general names of sulphurets or hydro-sulphurets of soda; my said invention being by no means applicable to the separation of sulphur from soda in the combinations which are called respectively the sulphate aud the sulphite of soda. And I do further declare, that the manner and means in and by which I do effect the purification of such soda, are as follows, (that is to say:)

I do precipitate such sulphur from such combination with the soda, by adding to a solution of the latter some one or other of the hereinafter mentioned salts of iron or of manganese, which salts may also be the most conveniently and advantageously applied in a state of aqueous solution; and on such addition being made, the sulphur sepa-

rates from its combination with the soda, and precipitates in union with the base of such metallic salt or salts, in the state of a metallic sulphuret or sulphurets, of a black or brown color respectively, according as salts with a base of iron or of manganese may have been employed. And I do further declare, that, in adding such salt or salts, the operator may be guided as to the proper and necessary quantities by observing that, in proportion as the effect intended advances towards completion, the operation proceeds more slowly, and the changes to black or brown, respectively, in the color of the precipitates from such metallic salts, take place visibly more gradually, until at length, upon the application of a suitable test, such as any soluble salt of lead or silver to a small portion of the solution in a test-glass, the base of such salt is precipitated in a visibly mixed state, consisting in part only of metallic sulphuret, of the usual well known color, and in part of such precipitate and of such color as such salt produces in solutions of pure caustic or pure carbonated soda, at which period of the process it becomes advisable to proceed with correspondent caution, and by only small successive additions of such salts of iron or of manganese to purify such soda, not only in order to avoid all waste thereof, but also to prevent the conversion of part of the pure caustic or carbonated soda into neutral salts of soda, by combination with the acid or acids of such metallic salts, which happens in case of the addition of such salts in excess. And I do further declare, that it is not difficult so to regulate the quantity of such metallic salts as aforesaid, so as to complete the operation of precipitating all such sulphur, as the solution operated on may contain, in the state of sulphuret or hydro-sulphuret, as before said, without any, or any material excess, of the metallic salts, by due attention to the circumstances which have been already mentioned, and by waiting before each later addition of such salts of iron or of manganese, with intervening agitation of the alkaline solution, until all, or nearly all, such metallic precipitates as may have fallen in another state than that of sulphurets shall have passed into the latter state by absorption of sulphur from the liquor. And I do further declare, that when the whole of the sulphur shall have been perfectly precipitated, or as perfectly as, for the purposes such soda is intended, may be deemed necessary, I do separate such precipitate from such solution either by subsidence or filtration, or partly by both, or by any other of such well known methods in such cases as may be convenient. And I do hereby further declare, that when the entire precipitation of such sulphur shall have taken place, the alkaline solution, which is usually previously of a yellow or greenish yellow color, will have become nearly entirely colorless and limpid, and will no longer produce, nor will the soda it contains produce, if separated, any of the injurious effects which it or they would previously have produced, in discoloring such metallic matters, dyes, pigments, or mordants, as it or they would previously have discolored and will no longer act in such manner upon the surface or substance of metallic vessels, apparatus, or implements, as it or they would previously have done; or discolor or injure the quality of such soap as may be made by means of it or them. And I do further declare, that my aforesaid invention of a certain improvement or improvements in manufacturing or purifying soda, is capable of being used, not only by manufacturers of soda, in their works or manufactories, but also by themselves, or other persons out of or on other premises than such works or manufactories, or apart therefrom, and as a separate process of purification distinct from manufacture, so as to be applicable to the purification of previously manufactured or of imported soda or substances, containing either caustic or carbonated soda, whether manufactured by themselves or others, and either for their own use, or for the use of others; and that on this account I do claim the application of such invention, not only as a process of manufacture, but also as a process of purification, capable of being so used, as aforesaid, not only by manufacturers of soda, but also by dealers in the same, or by consumers thereof, for any use or purpose of trade or manufacture. And I do further declare, that all the following metallic substances may be more or less advantageously employed for the purification of soda, as aforesaid; that is to say, in the first place, and preferably all such salts of iron as that metal forms in combination with sulphuric, muriatic, nitric, or acetic acids, preferring such as may be most cheaply and conveniently obtained by purchase or manufacture, or as occasional residual products in

certain manufactures; and secondly, but less eligibly, all such salts of manganese, as that metal also forms with the aforesaid acids; but I do give preference to the salts of iron because no perceptible portion, if any, of that metal, or of its precipitate, is so acted on as to be dissolved, held, or retained in the solution or in combination with the soda or the salts of soda, whereas a small part of the manganese is sometimes, if not always, so retained as to constitute, in some cases, an objection to the use of its aforesaid salts, where perfect freedom of the soda from metallic impregnation is desirable. And I do also further declare, that it is merely a question of economy, to be determined according to circumstances, what are the limits of the proportions between sulphuretted soda, and soda free from sulphur, whether in a caustic or carbonated state, in any alkaline compound, which determine the direct application of my said invention to such compounds, without preparatory process, to be economically beneficial or advisable; but, speaking generally, the less the proportion of sulphuretted soda may be, the more advantageously may such invention be so directly, and without preparatory process, applied to the purification of such compound, and in cases where the proportion of such sulphuretted soda, approaches to near one-fourth the total quantity of soda free from sulphur in such compound, it will, in most cases, be advantageous, (especially for manufacturers of soda, who usually possess the requisite facilities,) to previously subject such compound of soda with sulphuretted soda, to some of the usual carbonating processes, as they are called, and which are in common use, in order to get rid thereby of the greater part of such contaminating sulphur, and afterwards to operate on the product which is usually still contaminated with more or less sulphuret of soda, by means of my process of purification. And, speaking generally, for the guidance of manufacturers of soda, I do declare that I consider that the three or the four first runnings, from what is usually called, by manufacturers of soda, a tank or vat of soda-balls or lumps under the process of lixiviation, may be advantageously purified by the direct application of my invention, such first runnings usually containing very little sulphuretted soda; but that with regard to all the subsequent runnings from such tank or vat, after such third or fourth, it will be usually economical to boil the salt in solution down to dryness, and to carbonate the same in the carbonating furnace, or otherwise to carbonate the same by some known process in the liquid state, without such boiling down, and afterwards to purify, by the application of my invention, such in so far carbonated soda, from such portion of sulphur, as it usually still remains contaminated with, even after the application of such carbonating process or processes; but I do not mean or intend hereby to claim as my invention any process herein mentioned which may be already known or in use, but I do hereby claim the improvement or improvements in manufacturing or in purifying soda by the process or method hereinbefore described, of precipitating the sulphur by means of such aforementioned salts of iron and of manganese from such sulphuretted soda as is usually found in mixture or in combination with caustic or carbonated soda, or with both in the greater part of those articles or substances as found in commerce, of or to which such caustic or carbonated soda constitutes or gives the value, and which are much deteriorated by such sulphuretted soda.—In witness whereof, &c.

Enrolled April 19, 1834.

Origin of Mouldiness.—"Water, which holds organic substances in solution, very frequently develops living beings, viz. the *infusares*, which belong sometimes to the animal and sometimes to the vegetable kingdoms. These substances, which have been regarded by certain naturalists as the product of spontaneous generation, ought to be considered with greater propriety as owing their appearance to the development of certain invisible germs which are scattered throughout nature with profusion, and which only require favouring conditions to assume their being, and to develop themselves." "I have completely satisfied myself that mouldiness is the growth in air of aquatic filamentous vegetables. I have seen, in the most distinct way, the aerial filaments of the mould springing from the stalks of the aquatic filamentous vegetables, sometimes by a production from the side, and sometimes by the sprouting out of the extremity of one of these aquatic filaments which, in coming into the air, become by that alone a filament of mould." "I dis

solved a drop of the most liquid portion of the albumen of a new laid egg in an ounce of water, and put it into a flask. This liquid was preserved for a whole year, exposed to the light and put into the dark, but it never exhibited the least trace of mould. It did not even develop a single atom of greenish matter." "A drop of acid in an ounce of water, produced mould in eight days. Mercury, whether in the state of a salt or of an oxyde, completely obstructs the appearance of mould."—*M. Dutrochet, in the Edin. Phil. Jour.* If the albumen of the egg so completely prevents mouldiness in water, might not this fact be taken advantage of in preserving in a sweet state the water on board ships? Albumen is not only harmless, but nutritive, and eggs are very cheap. W.

London Mechanics' Magazine.

CHEAP AND EFFECTIVE WATER FILTER.

Sir,—The filtration of water, used as a beverage in families, being now considered of moment as a preventive of some disorders, and conducing to the general good health of the human body, I beg the favor of your valuable assistance in laying before the public the following plan to effect it.

I am, Sir,

Yours respectfully,

Dec. 8, 1834. J. F.

Plan.

Put into an earthen vessel, such as those which are used by sugar-bakers to form their loaves in, with a *small* hole at the pointed end, some pieces of Turkey sponge, and on them a sufficient quantity of SMALL, *clean* pebbles, to a quarter of the depth of the vessel. Suspend this filter, the end downwards, in a barrel with the head out, leaving about two or three inches space between the end of the filter and the bottom of the barrel; the upper part of the filter *must be kept a little above* the top of the barrel, which should be always full of water. It is obvious that the sediment of the water will remain at the bottom of the barrel, and the *pure* water will *ascend* through the sponge and pebbles to the unoccupied portion of the filter. It might be suspended in a cistern, or water-butt, if more convenient. The pebbles and sponge should be cleansed occasionally.—*Ib.*

AN IRON STEAM-BOAT, the Vulcan, made at Manchester, and intended for the Lake of Zurich, arrived at Coblentz on the 30th of November last. It draws only 26 inches, and the whole vessel, except the deck, is of iron. The bottom plates are half an inch thick. The engine is of high-pressure. It is to be steamed up the Rhine as far as the depth of water will permit, and then taken to pieces and conveyed over land to Zurich.—*Ib.*

CAOUTCHOUC COATING A GOOD SUBSTITUTE FOR LEADEN COFFINS.

Sir,—The enormous expense which individuals are frequently put to, in the interment of their deceased friends, has for some time directed my attention to this subject, and I think I have now hit upon a plan which will greatly obviate such expense, and which will preserve the body as effectually as if laid in a leaden coffin. The mode by which I propose to effect this, is by the application of caoutchouc, or India-rubber, which being quite impervious to damp and air, must, of course, preserve the body as if preserved in clothes after the manner of the Egyptians.

The body to undergo this operation, being laid out, is to be brushed over with a solution of India-rubber five or six times, until it is of a sufficient thickness; this done, nothing else remains but putting it in a light wooden coffin, and interring it. If the subject is in a state of decomposition, I propose only wrapping it in an India-rubber cloth. I have tried this plan on small quadrupeds, and find it succeeds admirably, therefore, I see no reason why it should not succeed as successfully with a human body.

I am, Sir, &c.

Nov. 26, 1834. E. B.

NEW BALL PROJECTOR.—A French agriculturist, of the name of Billot, who has assiduously cultivated the mechanical arts, has invented a machine which will discharge 2,000 balls, each 8 ounces in weight, per minute, or 120,000 in an hour, and this without the slightest intermission. The action of this formidable machine may be arrested or continued at will; the balls are discharged from four different muzzles, which may be directed upon objects at a less or greater distance from each other, or they may be brought to bear simultaneously on one and the same point. Billot's machine, however, is not capable of carrying such balls a greater distance than 100 me-

tres, (about 110 yards;) but he asserts that he can improve it, so as to impel the same balls a distance of 450 yards, and with a velocity scarcely inferior to that imparted by gunpowder. In this case, he adds, he will be obliged to increase its weight from 80 to 310 lbs. He does not employ either air, spring, or combustible matter, in this new projectile; and his name is of some note among French mechanics as the inventor of two new levers, which are to be seen in the collection of the "Societe d'Encouragement" at Paris.—*United Service Journal.*

Bread from Wood.—Dr. Prout has clearly proved that all the chief alimentary matters employed by man may be reduced to three classes, viz. saccharine, oily, and albuminous substances, the most perfect specimens of which are respectively sugar, butter, and white of egg. The saccharine principle, in its extended sense, includes all those substances which are chiefly derived from the vegetable kingdom; it means, in fact, the same thing as what we commonly call vegetable diet. It comprehends all those substances, whatever their sensible properties may be, into the composition of which hydrogen and oxygen enter in the proportion in which they form water; for example, the fibre of wood, which chemists call *lignin*. Much skilful manipulation and delicacy of experiment were required to establish this result; but the nutritive property of the woody fibre—in short, that a tolerable good quartern loaf can be made out of a deal-board—has been proved by the recent labors of a German professor, and may be verified by any one who will take the trouble to repeat them. The following, says Dr. Prout, was the method he employed for this purpose:—In the first place, every thing that was soluble in water was removed by maceration and boiling; the wood was then reduced to a minute state of division, not merely into fine fibres, but actual powder; and after being repeatedly subjected to the heat of an oven, was ground in the usual manner of corn. Wood thus prepared, according to the author, acquires the smell and taste of corn flour. It is, however, never quite white, but always of a yellowish color. It also agrees with corn flour in this respect, that it does not ferment without the addition of leaven, and in this case sour leaven of corn flour is found to answer best. With this it makes a perfectly uniform and spongy bread; and when it is thoroughly baked, and has much crust, it has a much better taste than what, in times of scarcity, is prepared from bran and husks of corn. Wood flour also, boiled in water, forms a thick, tough, trembling jelly, like that of wheat starch, and which is very nutritious. The nutritious properties were first tried on a young dog; afterwards he fed two pigs upon it; and then taking courage from the success of the experiment, the professor attacked it himself. His family party, he says, ate it in the form of gruels or soup, dumplings, and pancakes, all made with as little of any other ingredient as possible; and they found them palatable and quite wholesome.—*Ib.*

Great Tank.—There is at Dover, on the western heights, a tank for water, capable of receiving more than 90,000 gallons, and, if I am rightly informed, often actually retaining that quantity. This tank receives the rain-water, which descends through subterranean channels, from some of the military works on still higher ground; the water on entering the tank passes first through a course of large shingles, and then through a wall or deep bed of sand, and thus becomes filtered and purified. The water, which is thus rendered of most excellent quality, would serve a garrison for some months.—*Ib.*

Perfection in Archery.—At the siege of Methone, a small city of Thrace, Philip of Macedon, father of Alexander the Great, was solicited by a soldier by the name of Aster, to be taken into his service, on account of his expertness in bringing down birds in their most rapid flight. "I will employ you," said the monarch, "when I make war upon sterlings," which greatly incensed the archer. Soon after he shot from a distance an arrow on which was written, "*To Philip's right eye*,"—which actually struck that organ. Philip sent back the same destructive arrow, with this inscription: "If Philip takes the city he will hang up Aster," which he afterwards did. Philip was ever after exceedingly angry, if any one mentioned the word *eye* in his presence.—*Scientific Tracts.*

Ducat.—The gold coin of Holland bearing this name was so called in honor of one Longinus, a duke of Ravenna, in the sixth century.—*Ib.*